CLAIMS

1. Apparatus for predistorting an input signal applied to a radio frequency (RF) power amplifier, the apparatus comprising:

an RF phase discriminator, for generating output signals indicative of phase and amplitude differences between two input signals;

means for coupling a portion of an RF amplifier input as a first input signal to the RF phase discriminator;

means for coupling a portion of an RF amplifier output as a second input signal to the RF phase discriminator, wherein the coupled portion of the RF amplifier output is scaled to be comparable with the RF amplifier input;

an analog-to-digital converter for converting difference signals generated by the RF comparator to digital form;

a computation module for deriving from the difference signals corresponding values of gain compression and RF amplifier output phase;

means for coupling a portion of the RF amplifier input to the analog-to-digital converter, to derive RF amplifier input values in digital form;

a digital memory, for storing in association with each other, values of RF amplifier input, gain compression and RF amplifier output phase; and

an amplifier predistorter, for adjusting the amplitude and phase of the RF amplifier input based on the stored values of gain compression and RF amplifier output phase, to compensate for distortion in the RF amplifier.

2. Apparatus as defined in claim 1, wherein the RF phase discriminator comprises:

first and second input terminals for receiving the first and second inputs derived from the amplifier input and output signals, respectively; and

first and second output terminals for outputting in-phase (I) and quadrature (Q) output signals containing phase difference and amplitude difference information.

3. Apparatus as defined in claim 2, wherein the analog-to-digital converter receives as parallel inputs the I component and Q output signals and generates the digital equivalents of these difference signals.

4. Apparatus as defined in claim 3, and further comprising:

means for coupling a portion of the RF amplifier input to a third parallel input of the analog-to-digital converter, which generates the digital equivalent of the RF amplifier input.

5. Apparatus as defined in claim 4, wherein:

the digital memory comprises a lookup table having data fields for storing RF amplifier input values and corresponding values of amplifier gain compression and amplifier output phase; and

the amplifier predistorter includes means for accessing the lookup table based on a current value of RF amplifier input, and retrieving the corresponding values of amplifier gain compression and amplifier output phase.

6. Apparatus as defined in claim 5, wherein the values of amplifier gain compression and amplifier output phase are stored in the lookup table as running averages, whereby any changes in amplifier distortion characteristics are automatically reflected in the lookup table and used to apply predistortion.

7. Apparatus as defined in claim 5, wherein the digital memory comprises additional lookup tables, each corresponding to a different RF amplifier operating frequency.

8. A method for predistorting an input signal applied to a radio frequency (RF) power amplifier, to compensate for amplifier distortion, the method comprising the steps of:

coupling a portion of an RF amplifier input as a first input signal to an RF phase discriminator;

coupling a portion of an RF amplifier output as a second input signal to the RF phase discriminator, wherein this coupling step includes scaling the RF amplifier output to be comparable with the RF amplifier input;

generating, in the RF phase discriminator, output signals indicative of phase and amplitude differences between the first and second input signals;

converting, in an analog-to-digital converter, the RF comparator output difference signals from analog to digital form;

computing from the digital difference signals corresponding values of RF amplifier gain compression and RF amplifier output phase;

storing, in association with each other in a lookup table, values of RF amplifier input, amplifier gain compression and amplifier output phase; and

predistorting the RF amplifier input in amplitude and phase, based on stored values of gain compression and amplifier output phase associated with a desired value of RF amplifier input.

9. A method as defined in claim 8, wherein the step of converting the difference signals to digital form comprises receiving as parallel inputs to the analog-to-digital converter in-phase (I) and quadrature (Q) difference signals from the RF phase discriminator and generating the digital equivalents of these difference signals.

10. A method as defined in claim 9, and further comprising:

coupling a portion of the RF amplifier input to a third parallel input of the analog-to-digital converter; and

generating the digital equivalent of the RF amplifier input.

11. A method as defined in claim 10, wherein:

the storing step comprises storing in the lookup table data values for the RF amplifier inputs and corresponding values of amplifier gain compression and amplifier output phase; and

the predistorting step includes accessing the lookup table based on a current value of RF amplifier input, and retrieving the corresponding values of amplifier gain compression and amplifier output phase.

12. A method as defined in claim 11, wherein the storing step stores running averages of the amplifier gain compression and amplifier output phase.

13. A method as defined in claim 11, wherein the digital memory comprises additional lookup tables, each corresponding to a different RF amplifier operating frequency, and wherein the storing step includes selecting a lookup table based on RF amplifier frequency, and storing in the selected lookup table values for RF amplifier input, amplifier gain compression and amplifier output phase.

14. A method as defined in claim 8, wherein the step of predistorting comprises automatically compensating for changes in amplifier characteristics that cause corresponding changes in amplifier distortion.